CEYLON.

REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE PERIOD

JANUARY 1, 1915, TO DECEMBER 31, 1915.

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1916.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE DIRECTOR OF AGRICULTURE FOR 1915.

IN order to effect a reduction in bulk, desirable at this time, the reports of the Divisional Officers are not attached, but extracts or summaries of them are embodied in the following survey of the work of the Department of Agriculture for the year 1915.

COCONUTS.

2. There are about a million acres under coconuts in Ceylon. The area steadily grows, especially in the northern half of the Island, where a large amount of land is available that could be put under this product. Signs are to be observed in the dry districts that the principles of dry farming for conserving moisture are coming to be understood and practised. Many plantations are now ploughed and harrowed. We have found from experiments at Peradeniya, Maha Iluppallama, and Chilaw that the most suitable implements for periodic stirring of the land and maintaining a soil mulch are light disc harrows of six or eight plates, with which the driver walks and not rides, and the Planet junior scufflers. For ploughing we use a light two-wheeled plough and a "Pony" plough (one wheel), but a completely satisfactory plough for this kind of work has not yet been produced. For plantation work in the tropics a plough should be as light as possible, with bolts and wearing parts reduced to a minimum. I am inclined to think that the "swing" type is preferable to the wheel.

3. Of our three greatest planting industries, the coconut fared worst during the year 1915. The exports of copra amounted to 1,208,529 cwt., as compared with 1,411,947 cwt. in 1914. The decline in value of copra exports, namely, from Rs. 23,247,919 in 1914 to Rs. 17,656,852 in 1915, was more serious. It amounted to 5½ million rupees. It was due principally to a slump which set in in the second quarter of the year, mainly owing to shortage of tonnage. Pound for pound rubber is worth twenty times as much as copra, and consequently it could much better afford high freights. The loss of the German market, and decline in shipments to the United Kingdom, were made up for to some extent by increased shipments to European neutral countries. The year closed with a restoration of the market to normal conditions and complete confidence in the outlook.

4. The returns from Maha Iluppallama show that on the irrigable cultivated land (7 years old), which is ploughed and disc harrowed, the number of bearing palms per acre averaged 24·4, as compared with 20·9 in 1914. The yield per bearing tree rose from 11·61 nuts to 17·21. These results are very greatly in excess of plot B, uncultivated, the figures for which were 2·73 nuts per bearing tree in 1914 and 4·07 in 1915. Mr. Corlett, in his report on Peradeniya, gives details of a new manuring scheme adopted on four selected plots, each containing four palms, as follows:—

Four palms 8 years old and four palms 12 years old.

Plot 1.—Nitrogen and Potash only.

Ammonium sulphate,	300 lb. per acre,	5 lb. per palm.
Sulphate of potash,	120 lb. per acre,	2 lb. per palm.
		7 lb. per palm.

Supplying 1 lb. each of nitrogen and potash per palm.

Plot 2.—Nitrogen and Phosphoric Acid only.

Ammonium sulphate,	300 lb. per acre,	5 lb. per palm.
Ordinary superphosphate,	333 lb. per acre,	5·6 lb. per palm.
		10·6 lb. per palm.

Supplying 1 lb. each of nitrogen and phosphoric acid per palm.

Plot 3.—Phosphoric Acid and Potash only.

Ordinary superphosphate,	333 lb. per acre,	5·56 lb. per palm.
Sulphate of potash,	120 lb. per acre,	2·0 lb. per palm.
		7·6 lb. per palm.

Supplying 1 lb. each of phosphoric acid and potash per palm.

Plot 4.—Nitrogen, Potash, and Phosphoric Acid.

Nitrolim,	333 lb. per acre,	5·6 lb. per palm.
Basic slag,	300 lb. per acre,	5·0 lb. per palm.
Sulphate of potash,	120 lb. per acre,	2·0 lb. per palm.
	753 lb. per acre,	12·6 lb. per palm.

Supplying 1 lb. each of nitrogen, potash, and phosphoric acid per palm.

Manures applied in March, 1915.

This experiment is duplicated on four plots of four palms each near the head kangany's lines, where the palms are under grass.

In September a plan of manuring was drawn up for the 10-acre plot of 8-year old palms, which have been brought up under the disc harrow. The plan is designed to test the value of lime, and is supplementary to that adopted for cocoa. The area is divided into 16 plots, 13 of which will continue under the disc, 3 being clean weeded only. The value of cultivation can, therefore, still be watched. Two tons per acre of lime, which is at the rate of 64 lb. per tree, was applied in September, to be followed six months later by the manures. The objects aimed at are to determine the effect of lime when applied to coconuts on these acid soils (*a*) when followed by sulphate of ammonia, (*b*) by nitrate of soda, (*c*) by organic nitrogenous manure (castor cake), each group being subdivided into plots for determining the effect of mineral manures—phosphoric acid and potash—singly or together, and in combination with nitrogenous manures, the necessary control plots being arranged for.

Manuring Experiments.

Extract from Report of Mr. M. Kelway Bamber, Government Chemist.

5. The general result of the manuring has demonstrated that such old coconuts (50 years and over), which represent an enormous acreage of the small native holdings in Ceylon, can be improved in vigour and yield by cultivation and manuring. The average yield per palm has steadily increased from 26·7 nuts in 1911 to 42·1 nuts in 1914 and 42·7 nuts in 1915, an increase of 60 per cent. No manure was applied in 1915. The application of a complete general mixture gave the largest number of nuts, raising the yield from 29 nuts per palm to 57 nuts, or 96·5 per cent., at a cost of Rs. 25 per acre. The application of a soluble mixture every six months gave even a larger increase, from 23·4 nuts to 54 nuts per palm, or 131 per cent., at a cost of about Rs. 25 per acre per annum.

The most remunerative return was obtained by digging in, or mulching round, the palms with sensitive plant (*Mimosa pudica*) and other weeds, and applying a mixture of basic slag and kainit in equal parts at 400 lb. per acre. The mixture costs about Rs. 11 per acre. The yield per palm increased by this treatment from 30·7 nuts in 1911 to 55 nuts in 1914 and 56 nuts in 1915.

A feature in the manuring results is the increased power of the palms to retain the young nuts, although 44 per cent. are still lost annually. Before 1914 the proportion of immature to mature nuts was always greater, but since 1913 a steadily increasing proportion of nuts has matured, viz., 37·5 per cent. in 1913, 51 per cent. in 1914, and 56 per cent. in 1915. The number of nuts required for a candy of copra (560 lb.) is still much higher than in the low-country, the average being 1,613 nuts.

The general appearance of the palms has much improved, the foliage being of a richer dark green and the fronds heavier. Several manurial experiments with young coconuts are being carried out, but results are not yet available for publication.

TEA.

6. The year 1915 was the most prosperous year that the Ceylon tea industry has experienced. The exports amounted to 215,632,727 lb., of the value of Rs. 122,457,825. It is the first time the exports have exceeded 200 million pounds, and they represent an increase of 11·3 per cent. on last year's figures (193,583,592 lb.). The value of the tea exported exceeded the figure of 1914 by Rs. 32,731,830 (£2,182,122), which is a measure of the prosperity the industry enjoyed.

7. The average price in London was the highest since 1889. Colombo sales have averaged 56·79 cents, compared with 46·35 cents in 1914. The area under tea at the present time is approximately 392,500 acres.

8. The prosperity of 1915 was due to a well-distributed rainfall and high prices. The first quarter of the year, instead of being dry, as is usually the case, was punctuated with constant showers, and this gave the trees a good start. Rain was plentiful till the last quarter, which was deficient through partial failure of the north-east monsoon rains. Complaints were made that high prices were inducing coarse plucking to the injury of quality, but this did not apply to an appreciable extent in Ceylon, which has gained experience by suffering from this practice in the past. At the same time it is very important for the welfare of the industry to bear in mind that coarse plucking should not be permitted, because Ceylon has many competitors to step into her place should her grades show any falling off in quality.

9. Shortage of potash has stimulated cultivation, which has been maintained at a high level, weeds being kept well under. I hear of one estate in Agrapatana which has yielded at the rate of 1,041 lb. made tea per acre all round. In the best districts prices have averaged 60 cents; with a yield of 700 lb., and an all in cost of 30 cents, a profit of over Rs. 200 per acre is shown. Labour has been plentiful and settled. On many low-country estates tea is being gradually replaced by rubber, and when that takes place labour is reduced, and more becomes available for the tea plantations.

Insect Pests of Tea.

10. The ravages of shot-hole borer of tea and tea tortrix have absorbed a great deal of public attention; especially that of the former. Mr. E. R. Speyer, who began his investigations into the life-history and activities of borer in March, has been able to arrive at certain definite results, the most important being the discovery that the true host plant of the beetle is the castor oil plant (*Ricinus communis*), from which vast numbers of beetles emerge, being compelled to find new homes. These excess swarms establish themselves in tea, which, next to castor oil, they prefer to any other plant. No measures for the control of the borer could therefore be successful so long as castor oil existed in the tea area. At altitudes at which tea is at present found to be immune the beetle is found in castor, which has been recognized by the planters at these elevations as a serious source of danger and exterminated. Legislation is now under consideration for the extermination, throughout the whole tea-growing area, of castor oil, which is not cultivated for commercial purposes, but to some extent for domestic use. Mr. Speyer is not yet ready with any definite advice as to control measures to be adopted. This question presents many economic as well as technical difficulties, but he has reached the stage of being able to determine the probable character of such measures, and to make a practical trial with one. His investigations have also given rise to several important discussions at our committee meetings, which have been followed with interest by the whole planting community.

11. Mr. Speyer has also proposed the breaking up of the vast tea areas by shelter belts of immune trees and undergrowth, in order to check migration and facilitate control. Wind belts have been recommended for controlling tea tortrix, found mainly in the Dimbula, Maskeliya, and Hatton districts. After much discussion the view has now crystallized that this pest, as well as shot-hole borer of tea, must be made the subject of special investigation.

MANURING EXPERIMENTS.

Extract from Report of Mr. M. Kelway Bamber, Government Chemist.

12. The green manuring treatment of these plots with an application of slag and potash at pruning has been continued, and large yields are still obtained, especially from the dadap and Albizzia plots. The 15 acres of Singlo Assam hybrid and Manipuri indigenous now easily run two years between prunings, the dadap plot yielding in the 23 and 24 months' pruning as much as 134 and 127 lb. of made tea per acre for the month. The character of the wood in the plots not treated with green manure for some years, especially Nos. 147 and 148, is beginning to deteriorate, and compares unfavourably with the dadap and Albizzia plots Nos. 149 and 150.

The total yield of tea from the three varieties grown, viz., Singlo, Assam hybrid, and Manipuri indigenous (dark leaved), for the periods between the last two prunings, both with and without rubber shade, are :—

	Pounds made Tea per Acre.
Singlo jât without rubber shade	.. 1,280
Singlo jât with rubber shade	.. 640, difference 640 lb., or 50 per cent.
Assam hybrid without rubber shade	.. 1,775
Assam hybrid with rubber shade	.. 640, difference 1,135 lb., or 64 per cent.
Manipuri indigenous, no shade	.. 2,273

The loss of crop, due to the shade of the rubber and competition with the rubber roots, is clearly demonstrated.

In all the plots, except No. 143, where the prunings have been buried since 1911, the alternate lines are deeply forked and the prunings heaped, an application of 100 lb. basic slag and 60 lb. of sulphate of potash being applied at each pruning. No advantage has been obtained by burying the prunings. Plot 141 prunings heaped gave 608 lb. per annum in 1914 and 1915 ; plot 142, Singlo jât prunings heaped, gave 710 lb. per annum in 1914 and 1915 ; plot 143, Singlo jât prunings buried, gave 595 lb. per annum in 1914 and 1915. Plot 155, manured with cattle manure in 1909 and 1911, continued to yield well until 1915, showing the lasting effect of this kind of manure. This year showed a considerable falling off compared with last pruning year, viz., 549 lb., against 854 lb., but the decrease is partly due to several bushes having been killed out by the cora weed (*Cyperus rotunda*). Varieties of sweet potato have been planted through the tea on the affected areas, but the effect is only temporary, the weed re-appearing as soon as the cover plant is removed.

A new series of experiments in manuring, and the effect of different methods of plucking, are being begun in 1916.

RUBBER.

13. The export of Ceylon produce amounted to 48,803,816 lb., compared with 34,353,099 lb. in 1914, an increase of 42·07 per cent. The value was Rs. 78,996,940, as compared with Rs. 57,220,158 in 1914, an excess of 38·06 per cent. These are very satisfactory figures. The average price in Colombo may be set down at Re. 1·55 per lb., but a marked rise took place at the end of October. One noteworthy feature was the recovery of the popularity of crêpe, which has established a lead over unsmoked sheet, due to the fact in all probability that manufacturers at home, pressed by the British Government for the rapid completion of war material, have been able to dispense with drying and cleaning in the case of crêpe, which has in consequence found a higher demand. The area under rubber in Ceylon is about 240,500 acres. The range over which rubber can be profitably grown is very much less than in the case of tea, which is cultivated up to an elevation of 7,000 feet, the limit for rubber being about 2,000 feet. The land suitable for rubber has nearly all been planted in Ceylon, so the acreage is not likely in the future to undergo much expansion, except at the expense of tea in the low elevations.

14. A considerable amount of thinning out has been done, but the number of trees per acre on most estates is not less than 150.

RUBBER TAPPING EXPERIMENTS.

15. Tapping fashions change so rapidly that it is difficult for us at Peradeniya to keep pace with them. Some of the systems now under trial are no longer practised, and have, therefore, lost much of their value. These experiments are bringing to light some interesting complications connected with rubber tapping that were not at first foreseen, and which are not now generally realized. It is found that the merits of various tapping systems cannot be judged of by the output of dry rubber in any one year, unless the tapping cuts on the trees under experiment descend at the same rate and occupy at all times corresponding positions on the trunks. This is due to the fact that the flow of latex increases as we descend the trunk. Results should, therefore, always be corrected for position. The rate of consumption of bark is also to be considered. Too coarse tapping does not give the tree a fair chance ; it carries us over the rich positions too rapidly. If tapping is too fine, the flow of latex declines. From these and other disturbing elements, such as the position of the trees in the plantation, the identity of the rubber tapper, it will be seen that tapping experiments should be carefully studied before conclusions are accepted. A bulletin is being prepared on the 1915 results.

MANURING EXPERIMENTS.

Extract from Report of Mr. M. Kelway Bamber, Government Chemist.

16. All the manured rubber is tapped on alternate days on the one-third system, with a single cut left or right at 26 inches from the ground, the tapping being done by one cooly. The manures were applied in February, 1913, and again in 1915, the tapped trees in each row only being manured in the

latter year. The mixtures were made to demonstrate the effect of a general organic mixture, excess of nitrogen, potash, and phosphoric acid, and a general mineral mixture. Each manured plot was separated from the next by one unmanured row of rubber. The average yield per tree of the manured plots was :—

1913	1·23 lb.	
1914	2·41 lb.	= 96 per cent. increase.
1915	3·29 lb.	= 36·6 per cent. increase.

The two plots receiving an excess of nitrogen and phosphoric acid gave the greatest increase in 1915 over 1914, viz., 1 lb. 1½ oz. per tree, while the excess potash plot gave less than the unmanured plot by 7 oz. per tree.

The effect of cutting out the cocoa in these plots in 1913 evidently had a considerable influence on the rubber trees in 1914, the control plot nearly doubling its yield, and the manuring will have to be continued for some years before the relative value of any special constituent can be determined. A detailed report of the tapping and manuring experiments will be published in a bulletin.

The average percentage of rubber in the latex from the unmanured and manured plots was 31 and 32·8 per cent., respectively. The smallest percentage, viz., 28·7 per cent., was in the latex from the trees tapped with four cuts three times a week, and the highest, 37·5 per cent., in the trees tapped in the same way once a week only. Daily tapping with one cut also gave a lower percentage of latex, 29·6 per cent., compared with 31·4 per cent. for alternate days.

The quantity of bark removed per tree from the manured lots from January 1, 1914, to December 31, 1915, was 16·78 inches, yielding 5·7 lb. of rubber, or about 3·50 inches of bark for 1 lb. of rubber in 1914, and 2·55 inches only in 1915, the average yield per tree being 2·41 lb. and 3·29 lb., respectively.

The average thickness of bark 1 inch above the tapped area and 1 inch below the first cut, *i.e.*, representing about 23 months' renewal, from the unmanured and manured trees is :—

	Original Bark.	23 Months' Renewal.
Unmanured	6·61 mm. ..	3·60 mm.
Manured	6·86 mm. ..	3·94 mm.
	·25 mm.	·34 mm.

representing an improved thickness in the manured bark of 3·9 per cent. in the original, and 9·4 per cent. in the renewed bark.

Excess of potash and the mineral mixture had the greatest effect on the thickness of bark, the latter increasing the original by 11·4 per cent., and the renewed bark by 19·5 per cent., while phosphoric acid had the least effect. It has still to be shown that a thicker bark will necessarily give more latex, as careful measurements of six poor yielders and six good yielders gave the following figures :—

	Thickness of Bark 1 in. above Cut.	Thickness of Bark 1 in. below Cut.
Poor yielding tree	6·25 mm. ..	4·00 mm.
Good yielding tree	6·16 mm. ..	3·60 mm.
	·09 mm.	·40 mm.

or 1·46 per cent. better thickness of original bark and 11·10 per cent. better renewed bark in the poor yielding trees.

Comparing the thickness of bark for 36 trees along the outer edges of the plots, where there is ample air and light, with 36 trees about six rows or 110 feet inside, the thickness was 6·64 and 6·69 mm., a difference almost negligible. Another point of interest is that the increase of girth in 1915 compared with 1914 was rather less on the manured trees than the unmanured, the average girth of all the trees under tapping being 35·27 inches in July, 1915 :—

	Mean Increase in Inches. 1914.	1915.
Unmanured	4·69 ..	3·53
Manured	4·37 ..	3·24
Difference ..	·32	·29

The rainfall and number of wet days for the two years were :—

	1914.	1915.
Rainfall	82·72 inches ..	87·59 inches
Number of wet days	178 ..	153

The difference in climatic conditions was comparatively slight, and the smaller development in the trees in 1915 is probably due to the effect of slight overcrowding.

RUBBER RESEARCH.

17. These experiments are being carried on in conjunction with a group of plantations and the Imperial Institute in London, an arrangement which secures the confidence of planters, and ensures the advantage of independent investigation at home under conditions similar to those experienced by British manufacturers, with whom the Imperial Institute keeps in touch. The samples of rubber destined for vulcanization by the Imperial Institute have been prepared by Mr. L. E. Campbell, Rubber Research Chemist, those intended for direct comparative test being made from bulked latex collected in one day from reserved trees. In experiments of this nature uniformity of preparation is a very necessary condition if all suspicion of subsidiary influences is to be eliminated, and this condition has, in the case of our rubber research work, been fulfilled. Mr. Campbell worked through a scheme of preparation designed to cover the whole of plantation practice in the manufacture of thick and thin crêpe, smoked sheet, and

block. It included preparation by acetic acid and other coagulants in varying strength and degrees of temperature ; the effect of formalin and other re-agents for retarding coagulation ; and rubber from old and young trees. 360 samples in all have been prepared, and reports received on 140 of these.

18. The results, as far as they have gone, are set out by Mr. Campbell in his report. They go to show that, as to the main features, there is not much the matter with plantation practice. Acetic acid is about the best coagulant that could be used. The quantity necessary varies according to the quality of latex, the limits in Ceylon being from 1 part of pure acid to 600 parts of pure latex, in exceptional cases to 1 in 900, the usual proportion required being about 1 to 800. There is no doubt, however, that on some plantations little heed is given to the correct mixing of the coagulant, which may vary in strength from day to day, and this accounts for a good deal of trouble in working. Some system of co-operation between planters should be devised, under which more uniformity in strength of acid used could be obtained. Every factory should possess glass measuring vessels, in order that the acid may be added accurately and stock solutions made.

19. Much of the prejudice against crêpe would appear from our investigations to be unfounded. Crêping does not seem to injure appreciably the quality of rubber as indicated by tensile strength and elongation, though the first few workings of the fresh coagulum lengthen the time of cure.

20. The testing plant of a large and well-known manufacturing firm in England is being so arranged that their tests may be comparable with ours at the Imperial Institute. This co-operation will ensure that our work is conducted along practical lines.

EFFECT OF TAPPING ON FOOD RESERVES OF HEVEA.

21. These investigations, the advisability of which was first indicated at a meeting of the Committee of Agricultural Experiments in March, 1913, have been carried by Mr. L. E. Campbell to a definite stage, though they are not yet concluded. We were quite ignorant of the effect of tapping on food reserves, and apprehensions were felt that in the case of some of the systems in vogue permanent injury to the trees might eventually result. Trees under heavy and light tapping were selected and effects studied for a year, with the result that with careful tapping and a small number of cuts there were no grounds found for the apprehensions entertained. Starch was not withdrawn from wood or bark, except in the immediate neighbourhood of the tapping cut; and this limited and local withdrawal had apparently no injurious effect upon the tree. Of the different systems of tapping, the evidence was in favour of a change-over system with a single cut over half, a third, or one-quarter of the tree's circumference. From the point of view of bark renewal there was presumptive evidence in favour of the now popular system of changing the cut over from one side of the tree to the other at intervals of some months, usually six.

RESTING PERIOD OF RUBBER TREES.

22. Mr. Campbell has also carried out investigations into the storage of plant food at different seasons of the year, with a view to determining whether the period chosen in Ceylon for resting trees corresponds in time and in length with that period during which the starch reserves of trees is most heavily drawn upon. Rubber trees are, as a rule in Ceylon, rested when they winter or shed their leaves, tapping being resumed again when the new young leaves appear. This wintering time usually lasts for about six weeks, in February and March; but during this period, when the trees under observation by Mr. Campbell were leafless, the amount of starch stored in the bark and wood showed no signs of decreasing. Withdrawal of starch began with formation of new leaf, attaining its maximum when the new leaves were fully formed. The cells showed no signs of replenishment till three weeks afterwards, and complete recovery did not take place till a further two months had expired. It has been shown that though the influence of tapping upon reserves of starch is very localized, yet some influence is exerted, and Mr. Campbell recommends that tapping be suspended during the time occupied by the tree with new leaf formation, and for a period of at least three weeks afterwards. This would contribute to the welfare of the tree by relieving it of one drain upon its resources while another temporary but severe drain was being exercised, and is the manifest course suggested by these investigations.

COCOA.

23. Exports in 1915 were 83,483 cwt. as compared with 54,633 cwt. in 1914, and the value Rs. 3,128,942 and Rs. 2,062,942, respectively. In comparing the years it should be borne in mind in the case of all products that marauding enemy cruisers interrupted shipping traffic in the last quarter of 1914. Cocoa is grown in Ceylon from 500 feet to 1,800 feet above sea level, there being approximately 22,000 acres under the crop. The average price was Rs. 37·48 per cwt. compared with Rs. 37·76 in 1914.

MANURING EXPERIMENTS.

24. Several new experiments have been initiated at Peradeniya. The manuring experiments started in 1906 were re-cast in a modified scheme, the main design of determining the influence of nitrogen, potash, and phosphoric acid upon the yield of cocoa being continued. But, instead of there being, as was the case, 23 plots under different treatment, there are now 33 plots divided into three groups of 11 plots, the groups repeating each other, thus providing a system of checks.

25. The mixtures were arranged on a basis of 30 lb. nitrogen, 30 lb. phosphoric acid, and 30 lb. potash per acre. They are to be applied annually, the method of application being to fork them in within a circular area 1 foot broad at a radius of 4 feet from the base of the tree.

26. The influence of nitrogen, phosphoric acid, and potash can also be ascertained by applying excesses instead of omitting them, or by the application of single manures and not mixtures. These systems are in use for comparative purposes.

27. In No. 11 sulphate of ammonia is employed to give immediate results, and castor cake because we have found that though slower it is more lasting. This plot receives 40 lb. per annum.

UP-BRINGING OF YOUNG COCOA.

28. Experiments have also been established to ascertain the most favourable spacing for Forastero cocoa at this elevation, the most suitable temporary shade for protecting the young plants before permanent shade had had time to develop, the best spacing for permanent shade, the best green manures to employ while the cocoa is young, and also whether seed at stake or the planting-out system is preferable.

This experiment is known as C Cocoa. It occupies 1⅛ acre, divided into four plots. The cocoa spacing is 20 feet by 20 feet and 18 feet by 18 feet; permanent shade (*Erythrina*) spacing 20 feet by 20 feet thinned out to 40 feet by 40 feet, 18 feet by 18 feet thinned out to 36 feet by 36 feet, and 18 feet by 18 feet not thinned out. The temporary shade in all cases was palm leaves, with the addition in plot 3 of pigeon pea (*Cajanus indicus*) sown 4 feet from the cocoa.

29. I have referred elsewhere to the liming experiments in B Cocoa.

THE CINNAMON INDUSTRY.

30. A study of the export returns, and of the circumstances connected with this industry, indicate that it is on the decline in Ceylon. From 1904 there was a steady rise in exports till 1909, when they began to drop. In 1913 they were the lowest for ten years, namely, 5,140,800 cwt. In 1915 they rose to 6,451,984 cwt.; but this figure was no doubt unduly inflated owing to the outbreak of war in 1914 interrupting exports, some of which were carried forward to 1915, when the seas became clear of marauding German cruisers. 2,000 acres of cinnamon were uprooted last year in one Province alone and planted with coconuts; in another, large areas have been replaced by rubber. In recent years cinnamon has fallen very much in price, owing probably to the more extended use of cheap Cassia bark from China.

31. Some twenty-five years ago, when the cinnamon boom was on, several thousand acres were planted up with a coarse variety, which at first yielded up to 300 lb. of bark per acre, but subsequently dwindled to 100 lb. and even 50. When the rubber planting boom came in and the price of labour rose, these plantations became unprofitable.

32. The white sandy soils of Negombo, on which the best cinnamon is grown, are proving under good cultivation well adapted for coconuts, which do not require skilled labour in the preparation of the product for market, as is the case of cinnamon, which must, moreover, be harvested in the wet seasons, and is altogether a more troublesome crop to grow.

RICE.

33. The most important work with which this Department has been connected in the experimental cultivation of paddy has been the introduction, by Mr. Corlett, of the canal and drain system of irrigation. The yield from this plot in the first crop of the year was at the rate of 33 bushels per acre, that from the second crop under the new system was 77 bushels per acre. The total amount of water supplied, including rainfall, was, according to rough computation, about 50 inches for a five months' crop, which is at the rate of 2·2 inches per week (23 weeks). In a paper on the "Irrigation of Rice in Ceylon," read before the Ceylon Agricultural Society on May 25, 1915, Mr. Balfour, Director of Irrigation, stated that, according to experiments carried out by him in the North-Central Province, a three months' crop of paddy required in one case 41 inches and in another 47 inches of water, including rain, a mean of 44, which is at the rate of 3·38 inches per week (13 weeks). The amount ordinarily used by the villager is in excess of this, hence the quantity applied at Peradeniya was moderate. The heavy crop was due largely, there is little doubt, to the fact that the water was drained off the land to a depth of 20 inches—the depth of the drain—at frequent intervals, allowing it to become aerated. With stream irrigation the villager never allows the land to dry, but keeps the water running all the time till about a fortnight before harvesting; under the tanks alternate irrigation of fields is necessary, and the land sometimes dries, but only on the surface.

34. Some instructive data on transplanting rice has accumulated through experiments covering several years, and carried out at Maha Iluppallama and Peradeniya and by the Agricultural Instructors. The usual village practice is to transplant two or three seedlings in the same hole.

35. In seven experiments carried out at different parts of the Island from 1907–15 with single seedlings planted 4 to 6 or 6 inches apart, the average yield was at the rate of 54 bushels per acre; and in eleven experiments during 1913–15, with three seedlings at corresponding spacing, the average yield per acre was 62 bushels. These results favour the village practice of putting more than one seedling in each hole. If selection of seed plants were resorted to, as at Peradeniya, single seedlings would probably be found sufficient. At Peradeniya and Maha Iluppallama single seedlings are put out, but at Peradeniya seed is used only from plants that tiller to at least 12 stalks, the selection being carried on from year to year. In the last transplanted crop at Peradeniya a yield of 77 bushels per acre was obtained from single seedlings from such selected seed, as compared with 35½ bushels per acre from the broadcasted plot. At Maha Iluppallama we found in regard to spacing little difference in yield for distances varying between 4 and 10 inches. Results of experiments by the Agricultural Society go to show 6 inches as the best spacing to adopt when transplanting paddy seedlings.

36. Molagusamba rice, introduced by Mr. C. Drieberg in 1914, is growing very successfully in the Kandy and Chilaw Districts, and is now becoming an established type in Ceylon. It is a fine white rice of a superior table type, giving 15 and 16 measures of rice per bushel of paddy, compared with 12 in the case of most local types. The period of growth is five months in the dryer and six in the wetter localities.

TOBACCO.

37. The experiments at Jaffna by Mr. Scherffius with new types of tobacco were continued during the year, certain definite results being reached. Perhaps the most important is the experience that cigar tobacco cannot be properly fermented at Jaffna in the small bulks dealt with in the peninsula under the conditions usually prevailing. We endeavoured to ferment ours, amounting to 1,400 lb. in weight, in a godown, but this godown not being air tight, the circulation of air, and consequently temperature and moisture, could not be controlled. The outside of the heap, which with such a small quantity meant the greater proportion, quickly dried, making necessary frequent re-stapling, which involved much undesirable handling. The temperature could not be maintained for sufficient time at the necessary level to bring out fully the aroma of the leaf. The godown being close to the sea the salt air injured the colour a little. To remedy these defects we are building a small fermenting house and a storeroom inland on the ground.

38. In another direction experience has been gained, though at some cost to the crop. Irrigation facilities at Jaffna are adapted, as Mr. Scherffius points out, for dealing with crops of about an acre in extent. Our plot being 10 acres, mechanical irrigation became necessary. We procured an

expulsor pulsating pump, with a capacity of 300 gallons per minute, and boiler. The plant was erected over a large deep well on the ground, and is working satisfactorily, but the conduits have given trouble. Iron having gone up so much in price we determined to try giant bamboos from Peradeniya, but they cracked under the excessive dry heat and had to be abandoned. We now propose to try underground piping. In the meantime a system of hollow palmyra logs and earth embankment was improvized, but was not completed as early as we should have liked, and consequently some of the crop is a little backward. Early in the year a Tobacco Committee, consisting of representative landowners, Mr. Scherffius, and the Government Agent, Mr. Horsburgh, as President, was formed with the object of identifying the people of Jaffna with the experiments in progress. It has proved very successful, and no better tribute to its efforts could be furnished than the fact that a syndicate of local capitalists has already been formed for the purpose of acquiring a piece of land near the Experiment Station to grow types recommended by Mr. Scherffius, when he is able to form definite opinions, and of curing the leaf according to his methods. The syndicate intends also to buy leaf from small cultivators who consent to grow the types required. This is a very practical step, and is a recognition that only by combination can effect be given in Jaffna to the knowledge gained.

39. The experiments were started in Jaffna, because a large number of cultivators found their means of livelihood threatened by Travancore having imposed excessive dues on Jaffna chewing tobacco and restricted imports. The restrictions having to some extent been modified the situation in Jaffna has been very much relieved, and the necessity for finding a new market no longer exists. I think it, however, a fortunate occurrence that we were led to Jaffna. It is the principal tobacco growing district in the Island. If we can grow tobacco worth 40 cents a pound as against 10 cents as at present, we are more likely to appeal to a tobacco growing people than to others.

40. Our work has attracted attention in other parts of the Island also, and at the present moment a project, promoted by European enterprise, is under consideration for the cultivation of tobacco in the Central Province.

THE ROYAL BOTANIC GARDENS.

41. The main work in the Royal Botanic Gardens during the year has been concerned with botanical collections, especially the planting up of the new Palmetum in the South Garden, and supplying the Arboretum. It has been under the immediate supervision of Mr. T. H. Parsons, the Curator. We propose taking in hand each collection by itself, and working it up with the object of eventually publishing in series form a complete account of them all. The bamboo will probably be the next undertaken. 243 palms, each species in duplicate as far as possible, have been set out in the new Palmetum, which may be regarded as an addition to that originally established by Dr. Trimen in this part of the Gardens. The completion of the scheme must await the establishment in the Arboretum of some species of dicotyledons, which are at present only growing in the South Garden.

42. The Arboretum is also being steadily worked through, gaps being supplied in the natural orders, of which 51 are now established, represented by about 375 genera. Special attention has also been given to labelling individual plants and erecting sign boards denoting the position of the various natural orders. A plan of the Arboretum, on which the position of each tree is recorded, is also in preparation.

BOTANICAL LABELS.

43. Small zinc labels are used at Peradeniya for labelling small plants ; large wooden labels, painted white with black lettering, for flower beds ; but for the greater proportion of trees and plants sun-baked brick labels are used, 14 inches long, 5 inches wide, and 3 inches thick. One end for a space of 6 inches is slightly bevelled back for the inscription. This bevelled space is painted black to receive the letters, which are $\frac{5}{8}$ inch deep, in white paint. The labels cost Rs. 12 per 100 delivered, and the labelling costs Rs. 15 per 100 ; total 27 cents, or 4½*d.* each. They last on an average two years, after which they have to be brought in and re-painted. During the last two years considerable arrears have been overtaken and now nearly all our trees are labelled. In the financial year 1913–14, 3,228 labels (brick and wooden) were put out, and in 1914–15, 3,081, 2,740 of which were brick. Of these, 488 were for new plants and 820 for trees and plants not previously labelled, mostly re-named and rare trees in the Arboretum. Brick labels were introduced by Dr. Trimen, and on the whole we find them the most satisfactory, especially as there is a brick kiln near at hand.

Abstract from the Report of Mr. H. F. Macmillan, Superintendent of Botanic Gardens.

44. The fernery has been extended towards the orchid collection and planted up with Ceylon ferns only, of which some sixty species are now represented.

Seedlings of *Victoria regia*, the giant water lily, have been planted, and are thriving well, some of the leaves already measuring 4 feet across.

The Gourami fish, introduced from Java in 1909, have rapidly increased in number and size. These are being numbered, measured, and weighed, with the object of distributing them to the various reservoirs and inland tanks, &c.

5,000 oil palm seeds of the Abepa variety were received from the Gold Coast. The bulk of these were sent to the Dry Zone Experimental Station, the remainder being distributed for trial at Kurunegala, Negombo, and Teldeniya.

The total number of visitors to the Gardens for the year was approximately 50,000.

The following trees and shrubs flowered for the first time :—

Monodora tenuifolia.	Salvia involucrata.
Cassia moschata.	Spathodea nilotica.

The principal species introduced during the year are as follows :—

Acanthus arboreus.	Desmoncus minor.
A. pubescens.	Erythrina christagalli.
Attalea macrocarpa.	Lithræa molleoides.
Cæsalpinia gilliesii.	Luehea divaricata.
C. melanocarpa.	Peltophorum vogellianum.
Cassia corymbosa.	Scheelea insignis.

HAKGALA BOTANIC GARDENS.

Many of the Eucalyptus have recently been identified. The following have done best :—

Eucalyptus longifolia (Wooly Butt tree).
E. bicolor (Victorian Bastard tree).
E. capitellata (Red Stringy-bark).
E. fibrosa (Brisbane Stringy-bark).
E. botryoides (Bastard Mahogany).
E. lehmanni (Lehmann's Gum).
E. gunii (Tasmanian Cider Gum).

HENARATGODA GARDENS.

The double coconut, *Lodoicea sechellarum*, which flowered in 1914 for the first time, and was pollinated by flowers of the male inflorescence sent from Peradeniya, is now bearing four nuts, varying in size from 6 inches to 14 inches in diameter. They have not yet attained their full size. This is the first time this interesting species has fruited in Ceylon.

CEYLON FLORA.

Extract from Report of Mr. G. Bryce, Acting Botanist and Mycologist.

45. Recent additions to the Ceylon flora as aliens were the following :—*Prunella vulgaris* L., *Stachys arvensis* L., *Veronica serpyllifolia* L., *Erechtites valerianæfolia* DC., *Salvia tiliæfolia* Vahl., *Sonchus arvensis* L., *Sesamum prostratum* Retz.

Two ferns new to Ceylon were collected, viz., *Gymnopteris tomentosa* (Lam.) Und., and *Ceropteris calomelanos* (L.) Und. There is no record of the introduction of the first.

In the Phanerogamic Herbarium 90 bundles of specimens of flowering plants and ferns, collected in Ceylon during Dr. Willis's time, have been systematically examined, and selected specimens have been mounted and added to the Herbarium. About 4,480 sheets of foreign ferns of the late Sir A. C. Lawrie's collection have also been mounted and placed in the Herbarium. In the course of examination of a white variety of *Centranthera procumbens* Benth. it was determined that all the Ceylon species of *Centranthera* have spirally striate seeds, a character assigned by Trimen in his "Flora of Ceylon" to *C. hispida* Br. alone. *Psoralea corylifolia* L., a species of *Leguminosæ* rare in the dry region, was recorded growing in the Nuwara Eliya District. *Cuscuta chinensis* Lam., only found about Colombo and very rare, was found growing in abundance on the hillside by the road to Ganoruwa.

LOW-COUNTRY PRODUCTS AND SCHOOL GARDENS.

Extract from the Report of Mr. C. Drieberg, Superintendent.

46. In purely native agriculture more or less normal conditions obtained, the paddy crop being an average one ; but owing to general retrenchment, which resulted in an increase in the unemployed, steps had to be taken to prevent a shortage in the local food supply. The Agricultural Society provided the necessary funds for encouraging the cultivation of quick-growing food crops, and, in co-operation with the officers of the Department of Agriculture, carried on a campaign in the villages, instituting inquiries and distributing seeds of vegetables and of short-lived cereals (such as sorghum), as well as cuttings of tuberous plants (sweet potatoes, &c.), which helped appreciably to increase the output of edible products and provide against any possibility of scarcity in the villages.

Lac Culture.

The origin of the Ceylon Agricultural Society's work in connection with lac is to be traced to a suggestion made by Professor Dunstan, Director of the Imperial Institute, that an attempt should be made to introduce the Indian lac insect into Ceylon. Previous unsuccessful attempts had been made by the Government Entomologist. Mr. N. Wickremaratne, then an Agricultural Instructor, was deputed to study lac culture at the Pusa Research Institute in 1913, and on his return in October of that year the first successful trial with imported brood lac was made on *Zizyphus jujuba* trees at Maligatenna, near Kandy. Since then very encouraging results have been obtained. The lac raised in Maligatenna with the co-operation of Mr. K. Bandara Beddewela, has been supplied to the Kandyan Art Association, and there used for lacquering. Brood lac has also been introduced into Angurumaduwa, near Tangalla, at which place lacquer work is a regular industry, as well at Jaffna, where *Zizyphus* trees are very common. Since 1913 lac has been regularly cultivated on Maligatenna on *Zizyphus jujuba* and *Schleichera trijuga*.

Lacquer workers in the Central and Southern Provinces have hitherto had to depend on wild lac, obtained with considerable difficulty from *Croton lacciferus*, and it is hoped that the systematic cultivation of the Indian lac insect in the Island will help to revive the decaying lacquer work industry.

Government Stock Garden.

The nursery section is one of the striking features of the stock garden, and there are at present nearly 5,000 seedlings in stock. The following have been established as hedges :—*Malpighia coccifera, Casuarina equisitifolia, Pithecolobium dulce, Pisonia morindifolia, Bixa orellana, Acalypha marginata, Lawsenia alba, Citrus limetta, Hibiscus rosa-sinensis, Duranta plumieri, Gliricidia maculata, Carissa carandas, Phyllanthus nivosus, Triphasia aurantiola.*

Among the grafts established are sapodilla on *Bassia longifolia*, mangosteen on *Garcinia xanthochymus*, orange on lime stock, lime on pomelo, and red on white *Plumeria*.

School Gardens.

The total number of Government School Gardens at the end of the year was 287 ; but there are also 56 grant-in-aid schools which have to be examined for the Government grant. The majority of school gardens continue to maintain a high standard of efficiency.

The following is a list of the awards made for good work during the year :—

Rupees Twenty Awards.—Hunumulla, Kumbaloluwa, Urubokka, Alawatugoda, Ankumbura, Gunnepana, Mahagama, Mediwaka, Beddewala, Hettimulla, Wakirigala, Tennepanguwa, Etambagaskada, Eppawala, Ambanpola, Awulegama, Gokarella, Makandura, Poramadulla, and Wariyapola.

Rupees Fifteen Awards.—Keenadeniya, Paragastota, Walallawita, Bussa, Kiula, Narandeniya, Hindagala, Nugawela, Paranagama, Yatawatta, Getiyamulla, Kehelwatta, Mawanella, Dippitigala, Ilukkumbura, Pallekanda, Soranatota, Mahaelagomuwa, Balalla, Boyagane, Buluwala, Giriulla, Itanawatta, Kankaniyamulla, Mahananneriya, Nakkawatta, Wadakada, and Weuda.

Rupees Ten Awards.—Ellakkala, Kirindiwela, Kumbaloluwa Girls', Halwala, Ittapana, Magedara, Katuwana, Mandaduwa, Walasmulla, Alapaladeniya, Kotapola, Panwila, Teldeniya, Leliambe, Naula, Ambepussa, Dikwella, Etampitiya, Haputale, Passara, Opanake, Iratperiyakulam, Galediulwewa, Galkiriyagama, Kendewa, Mahadiulwewa, Talgaswewa, Topawewa, Borawewa, Dahanekgedara, Diullegoda, Galgamuwa, Ibbagamuwa, Kuliyapitiya, Ma-eliya, Medagama, Narammala, Nikaweratiya, Talgaswewa, Tammennawetiya, Udawela, and Wekada.

SOME WORK OF THE EXPERIMENT STATIONS.

Abstract from the Report of Mr. D. S. Corlett, Manager of the Experiment Station, Peradeniya

TREATMENT OF YOUNG RUBBER PLANTATIONS.

47. The *Tephrosia candida* has been cut eleven times since sowing in June, 1913. Five cuttings per year yielded fifteen tons per acre of nitrogenous mulch.

COCOA.

In May and September, just before the monsoons, the dadaps were lopped to reduce their height and shade to decrease the fungus pest. A new system of applying copper sulphate to scraped canker areas on the stems has been tried, instead of cutting out the whole area. A 2-acre plot has been planted out to test spacing, shading, green manuring, and pruning.

An experiment in fermenting cocoa showed that cocoa fermented for one day gave a very bright colour, and sold in Colombo for as high a price as that fermented for three days. The highest price obtained for cocoa was in November, namely, Rs. 54·50 per cwt.

COCONUTS.

The plantation has been divided up into sixteen plots for manuring experiments. Seven have received a preliminary dressing of two tons burnt lime per acre. 354 coconut beetles have been destroyed in these ten acres during the year. Nurseries have been laid down with the big Java nuts and with selected varieties. The highest price obtained by auction for nuts was Rs. 46 per 1,000 in the month of February ; for copra, sold in Colombo, Rs. 75·50 per candy in March ; and for oil by auction Rs. 2·30 per gallon in February.

COFFEE.

The 13-year old hybrid coffee has been cut down to one-foot stumps, as it carried leaf-disease. The stumps have sent up healthy shoots, which will be pruned. The hybrid coffee plants round the show plots have recovered their health and are bearing heavy crops. One bush yielded 5¼ lb. dry beans at one picking. In June three new plots of Canephora, Quillon, and Uganda were planted out 10 feet by 10 feet under established dadap shade. Half a pound of basic slag has been applied to each plant. A small plot of Arabian coffee has been established. The 6-year old Robusta coffee plot has been divided up into six manuring experimental plots.

CROP RETURNS.

		1914.	1915.	Acreage.	Yield per Acre, 1915.
Tea (green leaf)	lb.	56,415	42,588	15	685 made tea
Rubber	lb.	—	1,541¾	—	—
Cocoa (April, 1914, to March, 1915)	lb.	21,726	31,039¼	38	7¼ cwt.
Coconuts	No.	103,899	96,820	34	2,848
Coconut oil	gals.	205½	207	—	—
Coconut poonac	lb.	1,827	1,300	—	—
Copra	lb.	9,958½	10,786½	—	—
Coffee	lb.	528½	553½	—	—

PADDY.

An average of 33 bushels per acre was obtained under ordinary village cultivation. The field has been prepared for a new system of cultivation with drainage and water control, and re-sown half broadcasted and half transplanted with selected seed. A plot of a new Philippine paddy has been sown.

SUDAN DURA

A red variety has been successfully grown, which seems specially suitable for this climate. About 30 bushels of all varieties have been distributed all over the Island.

MANILLA HEMP.

Plants received from the Philippines in August, 1914, are now 12 feet high, and suckers are being distributed.

Vanilla.

The vines are being gradually transferred from the dadaps to the Plumeria shrubs, and are making good growth.

Papaine.

The half-acre plot planted in June, 1914, was tapped for papaine from February to October, 1915, in various ways. It appears that tapping the fruits every ten days gives the best result, *i.e.*, about a quarter of a pound dry papaine per tree in seven months. The papaine sold for Rs. 3·50 per pound.

Economic Plots.

One acre of the proposed ten has been laid out with twelve varieties of fibre products and twelve of oil products.

Fruit and Vegetable Plots.

Manuring experiments on citrus have been instituted.

Bananas.

The fungus *Fusarium* has caused much damage. The plants are now giving their third generation of suckers.

Groundnuts.

Analysis of three varieties of ground nuts grown at Ganoruwa showed that the Ceylon variety contained the largest percentage of oil, and being the heaviest yielder is therefore the most remunerative. The calculated yield of nuts, oil, and cake (the latter containing about 6·2 per cent. oil) from the three varieties would be—

Variety.	Nuts per Acre. lb.	Oil per Acre. lb.	Cake residue per Acre. lb.
Spanish	367·5	161	206·5
Virginia Bunch	302·5	121	181·5
Ceylon	1,630·0	735	895·0

The nuts vary in size, 1 lb. weight containing 762 Spanish, 445 Virginia, and 685 Ceylon nuts; the latter having rather thicker skins, the proportion of skin and kernel being 3·25 and 96·75 per cent., respectively.

Show Plots.

Thymol, an important drug, has been added to our collection in the show plots.

Visitors.

Naturally, owing to the war, there has been a great falling off of visitors, save in local planters.

His Excellency Sir Robert Chalmers paid a visit on February 21. Early in the year the Right Hon. Sir West Ridgeway, late Governor of Ceylon, and Mr. A. Pearson, Governor of British North Borneo, visited the station. It was Sir West Ridgeway who was mainly instrumental in securing the station in 1902 for the Department. He expressed his pleasure at its progress.

Henaratgoda Gardens.

No new rubber tapping experiments have been started, but those originated by Dr. Lock have been continued. The plantation of two-year old trees from No. 2 tree has responded well to forking and mulching with the inter-sown *Tephrosia candida.*

Maha-Iluppallama Experiment Station.

Plot A, cultivated (17 acres), yielded 21,069 nuts, or 17·21 per palm. Plot B, uncultivated (6½ acres), 1,821 nuts, or 4·07 per palm.

Copra was well reported on in Colombo, and fetched in December Rs. 84·25 per candy.

A new plot of three acres was planted out in October with year-old palms 30 feet by 30 feet. Part was holed with dynamite.

The citrus trees are fruiting well.

Dry Zone Experiment Station, Anuradhapura.

Five new acres have been levelled and taken into cultivation.

Coconuts.

A nursery of 750 nuts was set out, with 90 per cent. germination.

Oil Palms.

Three acres were planted out in year-old plants of *Elæis guianensis*, 22½ feet by 22½ feet, and inter-sown with cow peas as a green manure.

SUGAR CANE.

The sugar cane plot without manure yielded at the rate of twenty tons of cane per acre.

COFFEE.

Robusta coffee having proved unsuccessful without shade has been re-planted under dadaps.

FRUIT.

Pines, citrus, bananas, guava, mulberry, grape vine, pomegranate, mango, and jak fruit are all doing well.

PLANT DISEASES.

BARK ROT.

48. Considerable anxiety arose during the year among rubber planters in certain districts, owing to the reappearance of a diseased condition on renewing bark of rubber trees, which has received the name of "bark rot." It has been the subject of frequent discussion at our committee meetings, fears being entertained by planters that it was infectious. It was described by one planter in September at that time as the most serious disease the rubber planter had to contend with. The symptoms are small black vertical lines that appear on the newly tapped surface and continue up into the renewing bark and down into untapped bark. Mr. Bryce's researches have afforded no grounds for supposing bark rot to be infectious. He still has the matter under investigation. The rot is prevalent only in the wet seasons, tending to disappear with the approach of dry weather. Measures now being tried by Mr. Bryce are designed to accelerate the healing of the wound caused by bark rot. Preventive measures have not so far been determined, owing to the fact that little is known of the cause of this diseased condition.

Abstract from Report of Mr. G. Bryce, Acting Botanist and Mycologist.

HEVEA DISEASES.

A smaller number of specimens were received for examination and report. The most prevalent disease was canker caused by *Phytophthora faberi*, a severe attack causing pod disease, and heavy leaf fall occurred in certain districts in July. A root disease of young rubber caused by *Poria hypolateritia* was recorded.

TEA DISEASES.

The usual diseases of tea were reported. The parasitic Alga, *Cephaleuros virescens*, was found in one case attacking the branches. The Botanist and Mycologist collected specimens of *Corticium salmonicolor* (pink disease) on tea branches, where the fungus was undoubtedly the cause of "branch canker."

COCONUTS.

Cases of bud rot were recorded from the Experiment Station, Peradeniya. A leaf disease caused by *Helminthosporium*, sp., was also recorded.

COFFEE.

A twig disease on Liberian coffee was observed. The fungus found corresponds closely with *Colletotrichum incarnatum* Zimm., which causes a branch disease in Java.

TOBACCO.

A tobacco plant received from Negombo was found to be attacked by *Bacillus solanacearum*. Plants received from the Jaffna Tobacco Trial Ground were found to be attacked by a *Fusarium*.

CITRUS.

The *Oidium* disease, or mildew of young leaves, of citrus species continues to be very common, and causes much damage. Preventive spraying with Bordeaux mixture could with advantage be carried out.

BETEL.

Various parasitic fungi were observed on a consignment of betel leaves from Madulsima. A *Colletotrichum* caused minute ochraceous spots ; in addition, *Phyllosticta piperis* Tassi, and a *Fusarium* were found.

PRICKLY PEAR.

Specimens of prickly pear from Vavuniya, sent by the Government Agent, Northern Province, were found to be heavily infested with cochineal insect. The plants thus weakened were being killed by *Colletotrichum*, sp., and *Glœosporium*, sp.

MYCOLOGICAL HERBARIUM.

About 400 Ceylon specimens have been added to the Mycological and Pathological Herbarium.

The Draughtsman and Photographer has added about 100 paintings and black and white drawings of Ceylon fungi and plant diseases to the general collection.

Mycological specimens have been supplied to the Philippines, United States of America, Uganda, Pusa, France, Kuala Lumpur, Cambridge, and Java.

A revision of the Discomycetes was begun by the Assistant Botanist and Mycologist. Berkeley and Broome's Ceylon type specimens in the Mycological Herbarium were critically examined, and microscopic slides were prepared from this material.

PLANT PESTS.

Abstract from the Report of Mr. G. M. Henry, Assistant Entomologist.

Tea.

49. *Zeuzera coffeæ*, Neit. (Red Borer) was reported from Maturata and Neboda in January, Wattegama in February, Pelmadulla and Ratnapura in April, Pelmadulla in May, Yatiyantota in August, Uda Pussellawa in September, and Halgranoya and Dehiowita in October. This pest can be regarded as a serious one only when it occurs in nurseries.

Heterusia cingala, Moore (Red Slug Caterpillar), was reported from Badulla in March, Ulapane in April, Matale in August, and Madulkele in November. The last mentioned of these outbreaks was a somewhat serious one.

Natada nararia, Moore.—This nettle-grub was reported from Namunukula, Madulsima, and Pelmadulla in October. None of the outbreaks appear to have caused grave alarm, and they disappeared on the burst of the north-east monsoon.

Lamellicorn larvæ.—Cockchafer grubs were reported as injuring tea from Talawakele in August, from Galaha in September, and from Ragalla in November.

Phytoptus carinatus (Ribbed Mite) was reported from Lindula in May and from Galaha in September.

Helopeltis antonii (Tea Mosquito) was reported from Ramboda in August and from Nawalapitiya in October.

Calotermes militaris (Tea Termite) was reported from Bogawantalawa in March.

Orgyia postica, Wlk.—The small tussock caterpillar was reported from Gampola in October and from Badulla in December.

Hevea.

Mariælla dussumieri (Rubber Slug) was reported as drinking latex from Udagama in March.

Scolytidæ (various Shot-hole Borers) was reported from Mahawela in March, from Haldummulla in April, from Ratnapura in October, and from Galboda and Matale in November.

Lecanium nigrum (Black Scale Insect) was reported from Puwakpitiya in August and from Kurunegala and Mirigama in October.

Batocera rubus (Root and Stem Borer) was reported from Pelmadulla in November. This pest would appear to be potentially the worst insect enemy of *Hevea* that has turned up so far in Ceylon, its attack being so insidious. Fortunately it is not very common at present.

Coconuts.

Nephantis serinopa, Meyr. (Black-headed Coconut Caterpillar).—A serious outbreak of this pest took place in the North-Western Province, where it was rather widespread.

Rhynchophora ferruginea (Red Weevil) was reported from Kosgoda (Southern Province) in June, and was observed at Peradeniya in December. This species, and the Black Rhinoceros Beetle (*Oryctes rhinoceros*), are seldom sent in, owing doubtless to their being so well known. While no "dirt-cheap" method of controlling them has been, or ever will be, devised, yet much may be done to mitigate their attacks by the ordinary practices of sound agriculture. It is seldom that really well-cultivated plantations suffer severely from pests of any sort, unless they are unfortunate enough—as is often the case in Ceylon—to have as neighbours slovenly and ill-cultivated estates or gardens, which act as constant reservoirs of all manner of pests and diseases. Pests of the nature and habits of the Red Weevil and Rhinoceros Beetle almost invariably prefer sickly trees, at least for the commencement of their depredations.

Paddy.

Leptocorisa varicornis (Rice Sapper).—An outbreak of this pest took place at Ganoruwa Experiment Station in December. It was controlled by means of hand netting.

SOME SUB-TROPICAL PRODUCTS.

50. Hickory King *Maize* grows at Hakgala and Nuwara Eliya, but cannot stand up against the winds without being supported by stakes. This would seem to rule out maize as a practical proposition for that part of the country.

51. *Acacia mollissima*, the bark-producing black wattle of Natal, grows well at these elevations (5,000–6,000 feet), but will not seed.

52. Experiments with *Soya bean* confirm results previously obtained in this and other localities. This product will not give the weight of crop per acre to make it of profitable cultivation.

53. *Manilla Hemp*, planted in 1914 at Peradeniya (elevation 1,600 feet), is now 12 feet high; and some new young plots put out during the year are growing well. On the other hand, at Hakgala (5,000 feet) it is stagnant. The results at Peradeniya are encouraging.

54. *Linseed* at Anuradhapura (low-country) did very little according to the tabulated yield, yet it was not a bad stand considering that it was not under irrigation. At Hakgala and Nuwara Eliya it did indifferently.

55. That delicious fruit, the *Persimmon*, yielded well at Hakgala, and is evidently well suited to that elevation. The tree should be in every up-country garden.

RECLAIMING THE JUNGLE.

56. Vast areas of the North-Central and Northern Provinces lie unproductive under jungle that will never in all probability be given time to become timber forests again. The soil is good, the rainfall fair, but badly distributed. For the best results therefore irrigation is required. In the middle of this jungle area we opened in 1913 an Experiment Station near the town of Anuradhapura, on the main North road. A reference to Mr. Corlett's report will show there are now growing on this land, once a waste, abundant crops of millets, peas and beans, tobacco, sugar cane, bananas, and other products. The station presents a good object lesson in the wilderness, and is evidence of the latent wealth yet possessed by this Island.

57. Among the most interesting of the new plots is that of the oil palm, 3 acres, laid out in September with plants raised from seed procured from the Gold Coast. The variety is the same as that referred to by Mr. Macmillan in his report, namely, the Abepa. This is the first oil palm plantation to be established in Ceylon. It is under irrigation, and the land between the young palms has been planted with various leguminous crops. Three acres of tobacco have also been set out, the varieties selected being White Burley, Dumbara, and Zimmer's Spanish. At the time of writing the crops look exceedingly well. A small curing shed is being erected at a cost of Rs. 160. Robusta coffee is also under trial, but has not yet hitherto done well. It was given no shade, but this omission has now been remedied, and new plants supplied. Coconuts, as we have already demonstrated at Maha Iluppallama, grow well in this kind of soil and climate under dry farming cultivation, supplemented by occasional irrigation. Orange and other citrus thrive at Maha Iluppallama. With the Sudan dura introduced, the pulses, and other food products raised on this Dry Zone Station, it is clear that the cultivator or planter would be provided with a wide selection from which to choose.

SUDAN DURA.

58. Forty bushels of this product, introduced by Mr. Corlett in 1914, were distributed through the Government Agents and the Ceylon Agricultural Society in five Provinces : North-Central, Eastern, Northern, Uva, and Central. Some good heads were received from Jaffna produced by Mr. A. Visuvanathan, whose crop was reported as good. At Delft, in Jaffna, an award of Rs. 10 was given by the Agricultural Society for a large well-grown crop. Reports from Jaffna state that, in spite of the exceptional drought, good crops of Sudan dura were raised in various localities, and seed is being reserved for next season. In the North-Central Province it is stated that 40- to 50-fold was reaped in one korale (Kalpe).

59. The pink and red varieties do the best at the Anuradhapura Experiment Station. The Indian do poorly in comparison with these Sudan importations.

SHORTAGE OF POTASH.

60. During 1915 no supplies of potassic manures from the deposits in North Germany were obtainable, and existing stocks soon becoming exhausted planters found themselves unable to continue their usual dressings. Sulphate of potash began to be used about the year 1898, when 54 tons were imported, muriate of potash in 1899, and kainit in 1902, in which year 819 tons of these three manures were imported. In 1912–13 imports had risen to 7,912 tons, an indication of the growth in the use of potash that had taken place, chiefly in dressings to tea, rubber, and coconuts. The subject of the shortage was dealt with fully in a paper contributed by Mr. A. Bruce, Acting Government Chemist, to the July number of the Tropical Agriculturist. Mr. Bruce pointed out that where good dressings of potash had been applied residues could be used up by intensive cultivation, and by more liberal application of nitrogenous and phosphatic manures, which in many cases has been done. Lime, to liberate potash and neutralize acidity, has come into greater use. From 2 to 3 cwt. per acre every two or three years was the usual quantity applied, but this in some cases is now being increased up to 10 cwt. every two years. In an article in the December number of the Tropical Agriculturist Mr. Bamber stated that experiments showed that for tea, and to a less extent rubber, potash had not the importance usually assigned to it, and that its popularity in Ceylon was no doubt partly due to advertisement by the German Potash Syndicate, whose business it was to sell potash. It is not unlikely that the experience now being gained will be turned to account in the future by reducing the proportion in mixtures of potash salts, which cost the planting industry in the twelve months before the war about a million rupees.

ACIDITY OF CEYLON SOILS.

61. At Peradeniya experiments were last year started to test the effect of correcting the acidity of the soil upon the influence of nitrogenous manures. Plot B Cocoa was selected for the trial. This is a little over four acres in extent, planted 15 feet by 15 feet in 1908. The trees bore their first crop during the year. The soil of this plot being analyzed, it was found that 2·3 tons of pure lime (CaO), equal to 3·03 tons of slaked lime, was required to correct acidity to the depth of 6 inches, and the experiment was arranged on this basis. A corresponding experiment in the adjacent 11-acre coconut plot was also initiated. It is possible that the acidity of our soils has not been sufficiently allowed for in manuring schemes adopted on estates, and that the full benefit of ammoniacal and organic nitrogenous manures has, through a deficiency of basic constituents, not been obtained. These experiments will, it is hoped, throw some light on these points, and are opportune, now that lime is being more extensively used for this purpose of neutralizing acidity and also for liberating potash in the soil.

ACETIC ACID.

Extract from Report of Mr. M. Kelway Bamber, Government Chemist.

62. While in England I visited the Charcoal and Acetic Acid Manufactory in the Forest of Dean, with the chief engineer who supervised the erection of the plant and the managers of two other Government acetate factories, to study the process thoroughly. The object in view was the starting of similar factories in the dry zone of Ceylon for the manufacture of acetate of lime, acetic acid, and charcoal from Virai (*Hemicyclia sepiaria*), and similar wood of no value for other purposes than fuel. An estimate of a plant for distilling from 3 to 5 tons of air dry hard wood per day of 24 hours producing charcoal and the usual by-products, including the manufacture of technical acetic acid, was obtained. The cost f.o.b. Glasgow was £3,705 sterling, to which would be added the freight charges and the cost of necessary buildings, approximately £5,000 in all.

Ten tons of Virai wood, as supplied to the Ceylon Government Railway for fuel, were sent to Colombo, and distillations made with charges of 1 and 2 tons to ascertain the actual yields of the various products. These confirm previous experiments, and compare favourably with woods employed for the

same purpose in other countries, where the cost per ton is heavier than it would be in Ceylon. The supply of Virai in parts of the North-Central Province and the Wanni is very large, the tree in certain areas forming about 60 per cent. of the forest, and it is proposed to erect a preliminary plant near the railway, where the forest can be tapped for 2 or 3 miles on either side. As the production and demand develops similar plants would be erected in other centres.

The dry branches and leaves of the Virai yield a high percentage of ash, 6·4 per cent., containing 9 to 10 per cent. of potash, and it is proposed to manufacture carbonate of potash as a secondary product of the Virai tree, or to utilize the ashes as manure.

Inquiries were also made at various nurseries as to suitable trees for re-afforesting the cleared areas, or for planting up on patana land at higher elevations, with a view to furnishing suitable timber in the future for tea boxes, &c., most of which has now to be imported.

The quick-growing trees recommended were various conifers, including the Corsican pine, American Cotton wood, Swamp Cyprus, *Taxodium distichum*, and varieties of Populus.

STARCH, SUGAR, AND THYMOL.

Extract from the Report of the Government Chemist.

63. Four varieties of sweet potato, which grow luxuriantly at Ganoruwa, were analyzed for starch and sugar content. The yellow and red varieties were similar in composition, containing an average of 1·45 per cent. dextrose and 16·45 per cent. of starch calculated on the fresh tuber. A pink variety contained 1·65 per cent. dextrose and only 13·44 per cent. of starch, while a pale tuber had 19·5 per cent. starch and 1·2 per cent. dextrose. The latter is very similar in composition to the ordinary potato, which is largely employed in Europe for the manufacture of starch and alcohol. The yields of these tubers per acre are being recorded, but a good crop is said to be from 4 to 5 tons per acre.

Owing to the demand for Thymol as an antiseptic, an experiment was made with the growth of Ajowan seed (*Carum copticum*) obtained from India. The plants grew freely, and were of two kinds, yellow and white, the seeds of which were collected separately for further sowing. The seed of the white variety yielded on distillation 2·2 per cent. of oil, containing 60 per cent. of Thymol.

Analysis of the mature bark for a para tree free from sand gave 0·9 per cent. of nitrogen, 5·25 per cent. of ash, the latter containing 41·8 per cent. of lime, 9·30 per cent. of potash, and 3·2 per cent. of phosphoric acid.

EFFECT OF DYNAMITE.

64. In 1912, 60 rubber trees were planted in one plot at Peradeniya in dynamited holes, and in an adjacent plot 56 trees were planted in holes not dynamited but hand dug. The spacing in each case was 20 feet by 20 feet. At the end of 1915 the girth and height of the trees were measured, with the following results :—

	Average Girth. Inches.	Average Height. Feet.
Dynamited	8·96 ..	23·58
Not dynamited	8·63 ..	20·80

So far as these figures go they would seem to indicate that the effect of dynamite, manifested more in the height than in the girth of trees, is not considerable.

CO-OPERATIVE CREDIT SOCIETIES.

65. During the year 1915 seven new societies were formed. Ignorance of the principles involved, and of how to overcome initial difficulties, are still serious obstacles to progress. We have now resolved upon a policy of concentration in certain selected districts. A significant example of the good effected by these societies occurred in the Southern Province. The Talpe Pattu Society purchased six tons of bone dust from a wholesale firm in Colombo for Rs. 100 per ton, and retailed it at Rs. 5·05½ per cwt., cost price with freight added. The local storekeepers had been in the habit of charging Rs. 6 per cwt. for bone dust, but after this transaction they reduced the price to Rs. 4·75. In the opinion of the villagers the local manure was usually adulterated with sand, but we had samples of both society and store manures analyzed after reduction in price had taken place and found them of the same value. Thus, through the influence of the society, the people got a better manure at a cheaper rate. Similar instances have occurred in other places.

SCHOOL OF TROPICAL AGRICULTURE.

66. Plans for opening of the School of Tropical Agriculture were begun in June, and the school was opened on January 15, 1916. At the time of writing it has 66 English-speaking students and 6 vernacular. In addition, 38 applications for admission have been recorded. We are compelled to refuse more admissions at present, because we have not the staff or equipment for dealing with a larger number of students in the practical demonstrations, which we have made a special feature of the course and are part of the daily curriculum. The students engage in manual work at these demonstrations and on their plots. The fees are Rs. 7·50 per mensem for tuition, Rs. 22·50 for board and residence. The boarding students are housed in two hostels. The opening ceremony, which was attended by about 300 people from all parts of Ceylon, was presided over by the Hon. Sir Anton Bertram, K.C. The Hon. Mr. A. S. Pagden, Acting Colonial Secretary; the Hon. Mr. C. S. Vaughan, Government Agent, Central Province; the Hon. Mr. W. A. Abdul Rahiman; the Hon. Mr. T. B. L. Moonemalle; the Hon. Mr. K. Balasingham; the Hon. Mr. Harry Creasy; the Hon. Mr. R. Huyshe Eliot; Mr. John Harward, Director of Education; Mr. H. F. Tomalin, Conservator of Forests; Mr. Hew Kennedy, President, Planters' Association; Mr. H. L. de Mel, President, Low-country Products Association; and many leading representatives from the planting, professional, and commercial communities, were present.

PUBLICATIONS.

67. *Annals.*—One number of the Annals was published during the period, containing the following articles :—

Vol. VI., Part I., August, 1915.

The Pseudo-sclerotia of *Lentinus similis* and *Lentinus infundibuliformis.* T. PETCH.
Further Corrections and Additions to Trimen's "Flora of Ceylon," 1893–1911. J. C. WILLIS.
Some Abnormalities of the Coconut Palm. T. PETCH.
The Effect of Lightning on Coconut Palms. T. PETCH.
Horse-hair Blights. T. PETCH.

68. *Bulletins.*—The following numbers were published during the period :—

No. 16.—Tapping and the Storage of Plant-food in Hevea Brasiliensis. L. E. CAMPBELL, May, 1915.
No. 17.—Hevea Tapping Results: Experiment Station, Peradeniya, 1914. T. PETCH, April, 1915.
No. 18.—Rubber Manuring Experiments at the Experiment Station, Peradeniya. M. KELWAY BAMBER, May, 1915.
No. 19.—Physiological Effects produced on Hevea Brasiliensis by various Tapping Systems. L. E. CAMPBELL, July, 1915.
No. 20.—Henaratgoda Experiments : The Effect of Different Intervals between successive Tappings of Hevea Brasiliensis. T. PETCH, July, 1915.
No. 21.—Rice Growing Experiments. G. HARBORD, August, 1915.
No. 22.—Seasonal Variations in the Storage of Plant-food in Hevea Brasiliensis and their relation to resting periods. L. E. CAMPBELL, September, 1915.

69. A large number of articles were contributed to the Tropical Agriculturist by the Director and members of the staff, some of whom also read papers at the Board of Agriculture meetings.

70. Progress reports on the various experiment stations are issued every two months. These contain useful data, and are published in the Tropical Agriculturist. The minutes of the meetings of the Committee of Agricultural Experiments, which meets every two months, are also published. They constitute valuable records of research work carried out by the Department from time to time, especially as regards coconuts, tea, rubber, and cocoa.

RECEIPTS AND EXPENDITURE.

71. The expenditure under the various heads of the Estimates for the financial year October, 1914, to September, 1915, was as follows :—

	Rs.	c.
Salaries	118,420	36
Travelling	7,465	35
Labour and upkeep, Peradeniya Gardens	15,438	98
Labour and upkeep, Hakgala Gardens ..	4,817	17
Labour and upkeep, Henaratgoda Gardens	2,915	17
Labour and upkeep, Nuwara Eliya Gardens	1,907	20
Labour and upkeep, Peradeniya Experiment Station	23,340	18
Labour and upkeep, Maha Iluppallama Experiment Station	5,159	78
Labour and upkeep, Dry Zone Station, Anuradhapura	9,518	83
Coconut Trial Ground, Chilaw ..	2,363	91
Upkeep of Library, Laboratory, Herbarium, and Museum.. ..	1,750	17
Incidental expenses	494	93
Stationery	1,171	35
Co-operative Credit Societies :—		
Travelling	830	78
Incidental expenses	43	23
Rubber Research :—		
Travelling	635	8
Purchase of latex	1,904	43
Conduct of investigation in London ..	6,094	7
Incidental expenses	1,031	51
Special Expenditure :—		
Experimental cultivation of tobacco ..	5,772	95
Total ..	211,075	43

72. Receipts :—

	Rs.	c.
Head Office (Publications, &c.)	373	87
Royal Botanic Gardens, Peradeniya	1,953	94
Hakgala Gardens	586	25
Henaratgoda Gardens	989	68
Experiment Station, Peradeniya	22,371	22
Experiment Station, Maha Iluppallama	1,359	68
Total ..	27,634	64

73. To this must be added the value of seeds and plants given gratis to Government institutions from the following :—

	Rs.	c.
Peradeniya Gardens	1,028	40
Hakgala Gardens	443	75
Henaratgoda Gardens	—	
Experiment Station, Peradeniya	75	0
Total ..	1,547	15

Peradeniya, April 8, 1916.

R. N. LYNE,
Director of Agriculture.